CLAIMS

1. A method for detecting hydrocarbons, the method comprising:

obtaining seismic trace data for a region of interest; and

processing the seismic trace data to determine at least one wavelet energy absorption factor as a function of position within the region of interest.

2. The method of claim 1, wherein said processing comprises:

calculating a wavelet spectrum for each of multiple positions in the region of interest;

fitting a parameterized model to the wavelet spectrum.

3. The method of claim 2, wherein parameters of the parameterized model include a gas absorption factor and a liquid absorption factor.

4. The method of claim 2, wherein the parameterized model is expressible as:

$$\hat{A}(\omega) = \begin{cases} a_1 + a_2\omega^{Q_L} & \text{for } 0 \le \omega < \omega_D \\ a_3 e^{-Q_G\omega} & \text{for } \omega > \omega_D \end{cases}$$

wherein ω is frequency, ω_D is a dominant frequency, a_1, a_2, and a_3 are constants, Q_L is a liquid absorption factor, and Q_G is a gas absorption factor.

5. The method of claim 2, wherein said fitting comprises:

scaling the wavelet spectrum to a predetermined length.

6. The method of claim 2, wherein said calculating comprises:

performing time interpolation on the trace data.

7. The method of claim 1, wherein said processing comprises:

selecting trace intervals with a sliding window;

padding the trace intervals with zero values; and

performing a Fourier Transform on the zero-padded trace intervals to determine discrete frequency spectra.

8. The method of claim 7, wherein said processing further comprises:

transforming each discrete frequency spectrum into a corresponding cepstrum;

separating wavelet information in each cepstrum from reflectivity information; and

determining a corresponding wavelet spectrum from the wavelet information in each cepstrum.

9. The method of claim 1, further comprising:

determining a background absorption function for the at least one wavelet energy absorption factor.

10. The method of claim 9, wherein said determining comprises:

fitting a straight line to the at least one wavelet energy absorption factor.

11. The method of claim 9, further comprising:

finding absorption factor anomalies by combining the background absorption function with the at least one wavelet energy absorption factor.

12. The method of claim 11, wherein said combining comprises:

subtracting the background absorption function from the at least one wavelet energy absorption factor to determine a deviation curve;

subtracting a predetermined threshold from the deviation curve to determine a thresholded curve; and

setting all negative thresholded curve values to zero to find the absorption factor anomalies.

13. The method of claim 11, further comprising:

displaying the absorption factor anomalies as a function of position.

14. The method of claim 13, further comprising:

identifying at least one absorption factor anomaly that exceeds a threshold as a probable hydrocarbon reservoir.

15. A hydrocarbon detection system that comprises:

a memory having hydrocarbon detection software; and

a processor coupled to the memory to execute the hydrocarbon detection software, wherein the hydrocarbon detection software configures the processor to retrieve seismic trace data from a storage device, and further configures the processor to process the seismic trace data to determine at least one wavelet absorption factor.

16. The system of claim 15, wherein as part of configuring the processor to process the seismic trace data, the hydrocarbon detection software configures the processor to calculate a wavelet spectrum for each of multiple positions in a region of interest, and further configures the processor to fit a parameterized model to each wavelet spectrum.

17. The system of claim 16, wherein parameters of the parameterized model include a gas absorption factor and a liquid absorption factor.

18. The system of claim 16, where the parameterized model is expressible as:

$$\hat{A}(\omega) = \begin{cases} a_1 + a_2\omega^{Q_L} & \text{for } 0 \le \omega < \omega_D \\ a_3 e^{-Q_G\omega} & \text{for } \omega > \omega_D \end{cases}$$

wherein ω is frequency, ω_D is a frequency where the wavelet spectrum reaches a maximum, a_1, a_2, and a_3 are constants, Q_L is a liquid absorption factor, and Q_G is a gas absorption factor.

18. The system of claim 16, wherein the hydrocarbon detection software configures the processor to scale each wavelet spectrum to a standard length.

19. The system of claim 16, wherein as part of calculating the wavelet spectrum for each of multiple positions, the hydrocarbon detection software configures the processor to perform time interpolation on the seismic trace data.

20. The system of claim 15, wherein as part of configuring the processor to process the seismic trace data, the hydrocarbon detection software configures the processor to select trace intervals with a sliding window, configures the processor to append zero-valued trace samples to the trace intervals, and configures the processor to perform a Fourier Transform on each trace interval expanded in this fashion to obtain corresponding discrete frequency spectra.

21. The system of claim 20, wherein as another part of configuring the processor to process the seismic trace data, the hydrocarbon detection software configures the processor to transform each discrete frequency spectrum into a corresponding cepstrum, and further configures the processor to determine a corresponding wavelet spectrum from wavelet information in each cepstrum.

22. The system of claim 15, wherein the hydrocarbon detection software further configures the processor to determine a background absorption function for the wavelet absorption factor.

23. The system of claim 22, wherein as part of determining the background absorption function, the hydrocarbon detection software configures the processor to fit a straight line to the wavelet energy absorption factor.

24. The system of claim 22, wherein the hydrocarbon detection software further configures the processor to find absorption factor anomalies by combining the background absorption function with the wavelet absorption factor.

25. The system of claim 24, wherein as part of said combining, the hydrocarbon detection software configures the processor to subtract the background absorption function from the wavelet energy absorption factor to determine a deviation curve, and further configures the processor to extract deviation curve values above a threshold to find absorption factor anomalies.

26. The system of claim 24, wherein the system further comprises:

a display coupled to the processor,

wherein the hydrocarbon detection software configures the processor to display the absorption factor anomalies as a function of position.

27. The system of claim 26, wherein the hydrocarbon detection software configures the processor to identify at least one absorption factor anomaly that exceeds a threshold as a probable hydrocarbon reservoir.

28. A method for detecting hydrocarbons, the method comprising:

receiving from a user an indication of a region of interest in a seismic data set; and

generating a display of wavelet energy absorption anomalies within the region of interest.

29. The method of claim 28, wherein said generating includes:

calculating at least one wavelet energy absorption factor as a function of position within the region of interest.

30. The method of claim 29, wherein said generating further includes:

determining a background function from the wavelet energy absorption factor; and

comparing the background function to the wavelet energy absorption factor to identify wavelet energy absorption anomalies.

31. The method of claim 29, wherein the at least one wavelet energy absorption factor is indicative of gas absorption.

32. The method of claim 29, wherein the at least one wavelet energy absorption factor is indicative of liquid absorption.

33. The method of claim 29, wherein said calculating includes:

determining wavelet energy absorption factor values that provide a least-square-error fit between a parameterized model and wavelet spectra extracted from the seismic data set.

34. The method of claim 33, wherein the parameterized model is expressible as:

$$\hat{A}(\omega) = \begin{cases} a_1 + a_2\omega^{Q_L} & \text{for } 0 \leq \omega < \omega_D \\ a_3 e^{-Q_G \omega} & \text{for } \omega > \omega_D \end{cases}$$

wherein ω is frequency, ω_D is a frequency where the wavelet spectrum reaches a maximum, a_1, a_2, and a_3 are constants, Q_L is a liquid absorption factor, and Q_G is a gas absorption factor.

35. The method of claim 33, wherein said calculating further includes:

scaling the wavelet spectra extracted from the seismic data set to a standard length before said determining.